Hiroyuki KASHIWADANI*: On the Japanese species of the genus *Pyxine* (Lichens) (1)

柏谷博之*: 日本産クロボシゴケ属について (1)

The genus *Pyxine* belongs to the family Physciaceae and includes about 35 species, most of which are distributed in tropical and temperate regions. For species of the present genus some regional revisions have been made in East Africa (Swinscow & Krog 1975a), North and Central America (Imshaug 1957), etc. Japanese species of *Pyxine*, in contrast, have not been revised before, though eight taxa have been reported in floristic studies by Nylander (1890), Müll. Arg. (1891), Hue (1900), and Kurokawa (1969). They are *Pyxine connectans* Vain., *P. endochrysina* Nyl., *P. limbulata* Müll. Arg., *P. meissneri* Tuck., *P. meissneri* var. *vulnerata* Hue (=*P. limbulata* (Hue) Asah.), *P. patellaris* Kurok., and *P. sorediata* (Ach.) Mont.

In the present study, the writer revised Japanese species of *Pyxine*, being mainly based on about 200 specimens of the genus preserved in TNS. As the results, he confirmed the occurrence of *P. endochrysina*, *P. limbulata*, and *P. sorediata* in Japan. In addition, the following five species are reported here to be new to Japan: *P. asiatica*, *P. cocoes*, *P. meissnerina*, *P. philippina*, and *P. subcinerea*. As pointed out by Swinscow & Krog, *P. patellaris* is regarded as a synonym of *P. copelandii*. *P. connectans* was excluded from Japanese flora (see under *P. subcinerea*).

I wish to express my sincere thanks to Dr. S. Kurokawa, National Science Museum, Tokyo, who gave me valuable advices continuously. I am indebted to the curators of the following herbaria for the loan of the type specimens; the Farlow Herbarium in Cambridge; the Conservatoire et Jardin botaniques in Genève; the Botanical Museum in Helsinki; the Department of Botany, Faculty of Science, Kyoto University in Kyoto; the Naturhistoriska Riksmuseum in Stockholm; the Botanical Institute of the University in Turku. Thanks are due to Dr. T. Seki of the Hiroshima University, Hiroshima for his generosity in providing me with his private collections of *Pyxine*.

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Pyxine Fr., Syst. Orb. Veget., pars 1, 267 (1825).

Type species: *Pyxine sorediata* (Ach.) Mont. (=*Lecidea sorediata* Ach.)

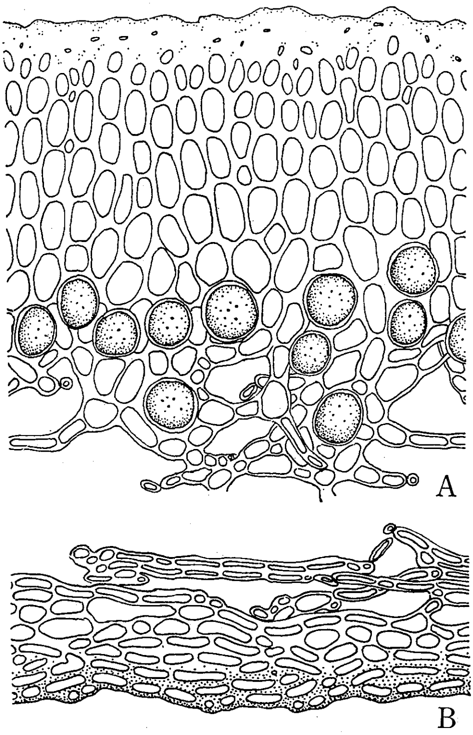

Fig. 1. Longitudinal sections of lobes of *Pyxine limbulata* Müll. Arg. (×1000) (A, upper cortex and gonidial layer; B, lower cortex).

The genus *Pyxine* is characterized by having foliose thallus, paraplectenchymatous upper cortex, dark brown hypothecium of apothecia, and brown spores of the Physcia type. The lobes are entirely corticate on upper and lower surfaces. The upper cortex is composed of 4-6 layers of thin-walled hyphae (Fig. 1A). The medulla is pigmented with yellowish orange or red pigments in most species. The lower cortex is dark brown and is composed of hyphae running more or less parallel to the surface (Fig. 1B).

The genus *Pyxine* has long been considered to have apothecia of the lecideine type (Zahlbruckner 1926, Poelt 1965, etc.). However, Imshaug (1957) pointed out that species of *Pyxine* have lecanorine apothecia with algal cells though some species have apothecia with carbonized (pigmented) thalloid exciple even in young stages as obserbed in *P. endochrysina*, *P. limbulata*, etc. (Fig. 2A). In *P. physciaeformis*, a tropical species, however, the thalloid exciple of apothecia are not carbonized even in mature stages (Fig. 2B), as usually observed in *Physcia* or *Dirinaria* in the family Physciaceae. There is another reason why *Pyxine* has been considered to have apothecia of the lecideine type, namely because it produces below hypothecium a tissue called "stipe" which has been often confused with the proper exciple. In some species this tissue is very

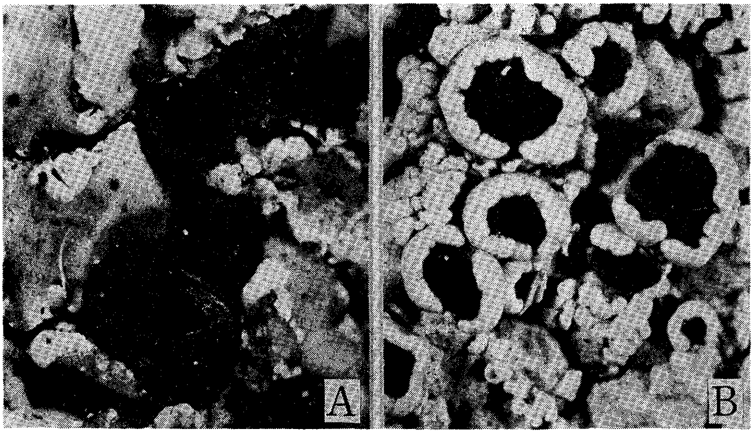

Fig. 2. Apothecia of *Pyxine endochrysina* Nyl. (A) and *P. physciaeformis* Malme (B) (×15).

distinctly reddish brown in color showing positive reaction with K (e.g. *P. endochrysina*, *P. limbulata*, etc.). In this case, medulla of the thalloid exciple is also often pigmented and it resembles proper exciple.

In regards to general morphology and chemistry, so detailed discussious have been made by Swinscow & Krog (1975a) that I have not found important features to add. The present genus resembles *Physcia* and *Anaptychia*, from which it can be distinguished by the presence of lower cortex of the Pulverulenta type (Kashiwadani 1976). It may be confused with the genus *Dirinaria*, because they both have similar lobes, spores of the Physcia type, and dark brown hypothecium. However, it can be distinguished from the latter genus by K+purple reaction in epithecium.

Key to the species of *Pyxine* in Japan

1. Thallus sorediate.. 2
  2. Soralia laminal and orbicular 3
    3. Norstictic acid present..........................*P. copelandii* Vain.
    3. Norstictic acid absent ....*P. asiatica* Vain.
  2. Soralia marginal and linear or lip-shaped........................... 4
    4. Soralia white... 5
      5. Medulla yellow ochre to orange yellow.......................... 6
        6. Thallus UV+yellow; lichexanthone present....*P. subcinerea* Stirt.
        6. Thallus UV−; lichexanthone absent....*P. sorediata* (Ach.) Mont.

5. Medulla white to yellowish white..............*P. cocoes* (Sw.) Nyl.
4. Soralia yellow ....*P. meissnerina* Nyl.
1. Thallus not sorediate... 7
7. Isidia present.....................................*P. endochrysina* Nyl.
7. Isidia absent 8
8. Lobes narrower, 0.5-1.2 mm wide; laminal maculae distinct; norstictic acid present ....*P. philippina* Vain.
8. Lobes broader, 1.5-3 mm wide; laminal maculae indistinct; norstictic acid absent ....*P. limbulata* Müll. Arg.

(1) **Pyxine asiatica** Vain., Hedwigia **46**: 171 (1907).

Type collection: Thailand, Ko Chang Island, ad corticem Arecae catechu prope Lam Dan, J. Schmidt—holotype in TUR (Herb. Vainio 08697).

Reaction: Thallus UV−, K+yellow; medulla P+orange red, K−, C−. Chemical substances; atranorin, P+unknown substance, and triterpenes.

This species is characterized by the greenish gray thallus with discrete narrower lobes (0.5-1.2 mm wide), the white maculae and white limbs of lobes, the laminal soralia, the white medulla, and the presence of P+(orange red) unknown substance. Apothecia not seen.

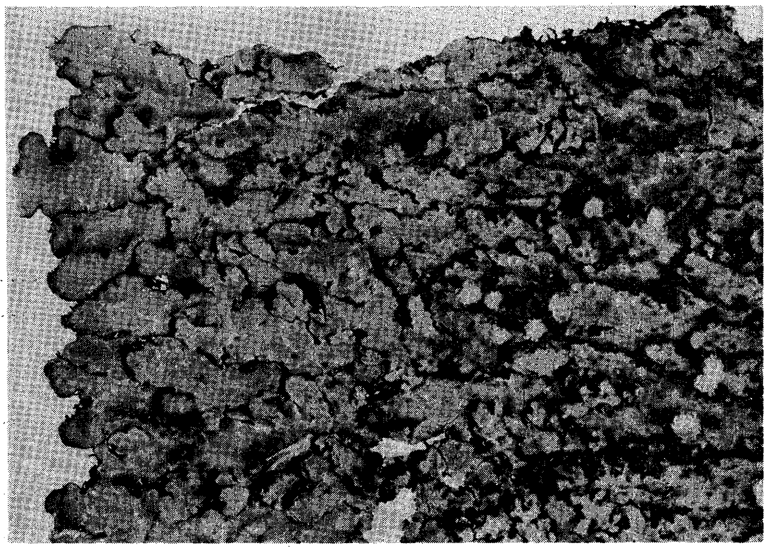

Fig. 3. A portion of the type specimen of *Pyxine asiatica* Vain. (×7).

Pyxine asiatica was described by Vainio from Thailand on the basis of a small sterile specimen (ca. 1×2 cm). Although the Japanese specimen is also sterile, it is quite identical with the type specimen in morphology and chemistry.

The P+unknown substance was first reported by Swinscow & Krog (1975 a) in some species of *Pyxine*. Even though this substance does not yield characteristic crystals in GE, oT, An, or GAW, the medulla containing it shows orange-red reaction with P. This substance is visible as a bluish white spot at Rf 0.29 on the chromatograms (developed with a mixture of hexane, ethyl ether, and formic acid=5:4:0.5) under a UV light, and the spot is pale brown after heating. It is, at present, known to occur in *P. asiatica*, *P. consocians*, *P. copelandii*, *P. philippina*, and *P. richardsii*.

This species seems to be one of rare species of *Pyxine* and has been known only from the type locality. However, the range now includes also Japan, where it grows on tree trunks. This is the second record for the species.

Specimen examined. Japan. Honshu. Prov. Ohsumi: Koseda, Kumage-gun, Yakushima Island, H. Kashiwadani 7266 (TNS).

(2) **Pyxine cocoes** (Sw.) Nyl., Mém. Soc. Imp. Sci. Nat. Cherbourg **5**: 108 (1857).

Lichen cocoes Sw., Nov. Gen. Sp. Pl. 146 (1788).

Reaction: Thallus UV+yellow, K−; medulla P−, K−, C−. Chemical substances; small amount of atranorin, lichexanthone, K−pigment, and triterpenes.

The diagnostic characters for this species are the broader lobes (1.5-3 mm wide) with marginal soralia, the heavy pruina on the upper surface of lobes, the white to yellowish white medulla, the reddish brown stipe (K+ red) of apothecia, and the presence of lichexanthone.

This species usually has only marginal linear soralia, but it sometimes also produces extensive laminal soralia on older lobes. The thalloid exciple of the present species is highly pigmented in mature stages. In young stages, however, it is not carbonized showing typical lecanorine appearance as observed in species of *Physcia* or *Dirinaria*.

Pyxine cocoes is a well known species of *Pyxine*, being widely distributed in tropical and subtropical regions. It has been reported from North America

(Imshaug 1957), Brasil (Vainio 1890), and East Africa (Swinscow and Krog 1975a). In eastern Asia, it is known to occur in the Philippines (Vainio 1913) and India (Awasthi 1965). The range now extends to Japan, but it is known only from two localities.

Specimens examined. Japan. Ryukyu Islands: Ishigaki Island, on bark of *Celtis boninensis*, H. Ando s. n. (TNS); Yagachi Island, M. Ogata 3661 (TNS).

(3) **Pyxine copelandii** Vain., Philip. Journ. Sci. **8**: 110 (1913); Swinscow & Krog in Norw. Journ. Bot. **22**: 52 (1975).

Type collection: The Philippines, Panay, Capiz, ad corticem arborum frondosarum, Copeland—holotype in TUR (Herb. Vainio 08703).

Pyxine patellaris Kurok., Bull. Nat. Sci. Mus., Tokyo **12**: 689 (1969). Type collection: Japan, Bonin Islands, Chichijima, H. Inoue 19027 (TNS).

Reaction: Thallus UV−, K+yellow; medulla P+orange red, K+yellow afterwards reddish yellow, C−. Chemical substances; atranorin, norstictic acid, P+ unknown substance, and triterpenes.

The present species is characterized by the narrower lobes (0.5-1.5 mm wide) with orbicular soralia, the laminal white maculae and white limbs of lobes, the colorless stipe (K−), and the presence of norstictic acid and P+ unknown substance.

This species has been reported by Japanese lichenologists under the name of *P. patellaris* Kurok., which was described on the basis of a specimen collected in the Bonin Islands. The holotype specimen of *P. patellaris* has orbicular soralia, maculate lobes, and white medulla. In addition, it produces norstictic acid as well as P+unknown substance. These characters indicate that *P. patellaris* is identical with *P. copelandii* as pointed out by Swinscow & Krog (1975a).

Pyxine copelandii may be confused with *P. asiatica*, from which it can be clearly distinguished by the presence of norstictic acid. In addition, soralia of this species are orbicular whereas they are cup-shaped in *P. asiatica*.

This species is known from Japan, Formosa, the Philippines, and East Africa. U. Faurie also collected it on Mt. Kilauea in Hawaii (Faurie no. 52, KYO), so that this species seems to be widely distributed in temperate and tropical regions in the world.

Specimens examined. Japan. Izu Island: Ako, Miyake Island, H. Kashiwadani 13699 and 13733 (TNS). Bonin Islands: Mt. Chuo, Chichijima, in the forest of *Schima mertensiana-Bladhia sieboldii*, alt. 100-300 m, H. Inoue 18993 (TNS). Formosa. Prov. Pingtung: Kural, Y. Asahina 3678 (TNS).

(4) **Pyxine endochrysina** Nyl., Lich. Jap. 34 (1890).

Type collection: Japan, Hiroshima, E. Almquist s. n. in 1879—lectotype in H (Herb. Nylander 31782).

Physcia glaucovirescens var. *tenebricosa* Vain., Bot. Mag. Tokyo **35**: 60 (1921). Type collection: Japan, Honshu, Prov, Nagato, A. Yasuda 256—holotype in TUR (Herb. Vainio 08581) and isotype in TNS.

Reaction: Thallus UV−, K+yellow; medulla P−, K−, C−. Chemical substances; atranorin, K−pigment, and triterpenes.

Diagnostic characteristics for the present species are the broader lobes (1.5-2.5 mm wide) with marginal scattered pseudocyphellae, the marginal and laminal isidia which are nodular or coarsely branched with age, the orange-yellow medulla (K−), the brown stipe (K+pink), the lack of lichexanthone, and the saxicolous habit.

Pyxine endochrysina can be easily recognized by the stout isidia which are 0.2-0.4 mm thick and 0.3-0.6 mm high. These isidia may have sparse pruina and distinct marginal white pseudocyphellae as observed in main lobes. The isidia of the present species are rather variable in density. In some specimens, lobes are very sparsely isidiate, while they are densely isidiate forming extensive mass of isidia especially on older lobes.

Vainio described *Physcia glaucovirescens* var. *tenebricosa* from Japan on the basis of a specimen collected by A. Yasuda. The holotype specimen has nodular isidia and yellowish orange medulla, which are characteristics of *P. endochrysina*.

Although the present species is commonly found throughout Japanese Archipelago and Formosa, it is rather rare outside of Japan, being reported only from Tanzania by Swinscow & Krog (1975a).

Representative specimens examined. Japan. Honshu. Prov. Mutsu: Hachinohe, U. Faurie 1261 and 1280 (KYO). Prov. Hitachi: Mt. Tsukuba, Y. Asahina s. n. (TNS). Prov. Musashi; Mt. Takamizu, Nishitama-gun, S. Kurokawa 51044 (TNS). Prov. Kazusa: Ichinomiya, Y. Asahina s. n. (TNS). Prov. Shinano: Uchiyama-kyo Gorge, Saku city, H. Kashiwadani 9601 (TNS). Prov. Izu: Cape Irohzaki, Kamo-gun, S. Kurokawa 58654 (TNS). Prov. Suruga: Mt. Kuno-san, H. Kashiwadani 10323 (TNS). Prov. Tohtomi: Misakubo-machi, Iwata-gun, Y. Asahina s. n. (TNS). Prov. Mikawa: Mt. Horaiji, Minamishitara-gun, H. Kashiwadani 9908 (TNS). Prov. Owari: Mt. Kinkasan, Y. Asahina s. n. (TNS). Prov. Ise: Hobara-mura, Watarai-gun, Y. Asahina s. n. (TNS). Prov. Kii: Cape Kuki, S. Kurokawa 59089 (TNS). Prov. Settsu: Mt. Rokko, Y. Asahina 22834 (TNS). Prov. Awaji: Mt. Yuzuruhayama, Mihara-gun, H. Kashiwadani 6584 (TNS). Prov. Mimasaka: Hoshiyama, Maniwa-gun, H. Kashiwadani 13069 (TNS). Prov. Oki: Kuniga, Chibugun, H. Kashiwadani 5854 (TNS). Prov. Aki: Miyajima Island, H. Kashiwadani 5648 (TNS). Prov. Nagato: Mt. Shizuki-yama, Hagi city, H. Kashiwadani 7132 (TNS). Shikoku. Prov. Awa: Sanagochi-mura, Myoto-gun, Y. Asahina s. n. (TNS). Prov. Iyo: Iwayaji Shrine, Kamiukena-gun, H. Kashiwadani 8519 (TNS). Prov. Tosa: Sakawa-machi, Takaoka-gun, H. Kashiwadani 8575 (TNS). Kyushu. Prov. Hizen: Nagasaki, U. Faurie 1529, 1729, 1759, and 1805 (KYO). Prov. Higo: Tomioka, Amakusa-gun, Y. Asahina s. n. (TNS). Prov. Buzen: Innai-mura, Usa-gun, Y. Asahina s. n. (TNS). Prov. Hyuga: Udo, Nichinan, H. Kashiwadani 8630 (TNS). Prov. Ohsumi: Kurio, Yakushima Island, H. Kashiwadani 7240 (TNS). Ryukyu. Mt. Amagi Ohshima-gun, Tokunoshima Island, H. Kashiwadani 2158 (TNS). The Amami Islands. Akusekijima, Ohshima-gun, T. Seki 19918 (HIRO); Kodakarajima, Ohshima-gun, T. Seki 20272 (TNS, HIRO); Takarajima Island, Ohshima-gun, T. Seki 20196 and 20199 (TNS, HIRO). Formosa. Prov. Taichung: Raisha, Y. Asahina F-100 and F-103 (TNS).

(To be continued)

□Ralph A. Lewin ed.: **The Genetics of Algae.** Botanical Monographs Vol. 12, 360 pp. Blackwell Scientific Publications, Oxford (1976). 約9,400円。「藻類の遺伝学」と銘打つ本が出た。今から25年程前．よく知られた Moewus のクラミドモナスの性物質などにかかわる研究成果の真偽の程が，真剣に論議されていた頃には予想もできなかったことである。一般に，藻類は遺伝研究の材料に向いていないと考えられ，また遺伝学者の藻類への親しみの少さもあって，藻類の遺伝学は置き去りにされてきた感があった。しかし，藻類の同調培養法，有性及び無性生殖の人工誘起の方法などの確立は，藻類が遺伝学の研究材料として好適な生物群であることを認識させるようになった。この本はごく最近になって急速に発展を見せつつある，藻類についての遺伝学分野の成果を総説したものであり，この分野の学問の現状を知るとともに，今後の進展の方向を予見する上で貴重な書といえる。扱われる藻類は，藍藻，緑藻クラミドモナスなどの単細胞性から，カサノリ，アオサ，シャジクモなど大型藻に及び，内容もファージによる生化学遺伝学などから，いわゆるメンデリズム遺伝学に至り多様である。最近流行の種分類学の仕事もいくつか紹介されている。（千原光雄）